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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/856,966	09/06/2001	Peter A. Dowben	UNVN.62457/0	5124

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EXAMINER

PALABRICA, RICARDO J

ART UNIT

PAPER NUMBER

3641

DATE MAILED: 04/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/856,966

Applicant(s)

DOWBEN ET AL.

Examiner

Rick Palabrica

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 April 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

1. Applicant's Request for Continued Examination in Paper No. 14, which includes new claims 14-25, is acknowledged.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 22-25 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. There is neither an adequate description nor enabling disclosure of a neutron detecting device comprising a first region formed of a p-type semiconducting boron carbide and a second region formed of an n-type semiconducting boron carbide, wherein these regions are electrically active parts of the device (see new claim 22).
3. Claims 1-11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "said changes" in line 4. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-5, 8 and 12-17, 19, 20 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seki et al. (JP 61-152084) in view of Seong-Don Hwang et al. (70 Appl. Phys. Lett. 1028, 1997). Seki et al. disclose the applicant's claims except for the use of boron carbide layer and a homojunction diode.

Seki et al. disclose a semiconductor neutron detector comprising a silicon substrate and a boron-10 film that form a heterojunction between them. Electrodes that contact the substrate and the film are provided (see Fig. 1). The boron film is formed by direct current plasma CVD method using $^{10}\text{B}_2\text{H}_6$. They also disclose the application of a reverse bias to the heterojunction to operate the device as a neutron detector. They also show in Fig. 1 an embodiment with multiple heterojunction diodes.

Seong-Don Hwang et al. disclose that heterojunction diodes and homojunction diodes can be formed using silicon substrate and boron carbide films. The boron carbide films can be either an n type or p type material. They teach that

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carbide devices are resistant to corrosive, high temperature and mechanically abrasive environments.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus, as disclosed by Seki et al., by the teaching of Seong-Don Hwang et al., to use boron carbide with silicon to form either a heterogeneous or homogeneous junction neutron detector, to gain the advantages thereof (i.e., ability to operate in harsh environments), because such modification is no more than the use of well-known semiconductor materials and diode configurations within the nuclear art.

For the benefit of the applicant, JP 59-158415 or JP 61-035384 also discloses neutron detectors using boron films on heterojunction diodes. The 3 Japanese references cited above, which were all published in the mid 1980s, show that the detector concept in the claimed invention is old technology.

5. Claims 6, 7, 10, 11, 21 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Seki et al. and Seong-Don Hwang et al., as applied to claims 1-5, 8 and 12-17, 19, 20 and 22-24 above, and further in view of the combination of Dowben (U.S. 5,658,834) and Lund et al. (Mat. Res. Soc. Symp. Proc., Vol. 162, 1990). The Seki et al. and Seong-Don Hwang et al. combination discloses the applicant's claims except for the boron enrichment and dimensions of the detector.

Dowben teaches a heterojunction semiconductor device comprising boron carbide film with thickness ranging from 0.1 μm to 1 μm on silicon (see column 2, lines

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46+). Lund et al. teach that boron coated, silicon detectors can have ^{10}B enrichment of up to 95% and be capable of operating above 500°C.

As to the limitation in claim 7 regarding the thickness of the silicon substrate, this is a matter of optimization within prior art conditions or through routine experimentation (see MPEP 2144.05 II.A).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus, as disclosed by the combination of Seki et al. and Seong-Don Hwang et al., by the teaching of Dowben and Lund et al., have a boron carbide thickness of about 1000 nm, silicon layer thickness of less than 600 nm, and boron carbide enriched to at least 80% boron-10, to gain the advantages thereof (e.g., higher detection efficiency), because such modification is no more than the use of well-known enrichment and detector configuration within the nuclear art.

6. Claims 9 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Seki et al., Seong-Don Hwang et al., Dowben ('834) and Lund et al. as applied to 6, 7, 10, 11, 21 and 25, and further in view of Dowben (U.S. 6,025,611). The combination of Seki et al., Seong-Don Hwang et al., Dowben ('834) and Lund et al. discloses the applicant's claims except for the use of a metal substrate.

Dowben ('611) teaches a boron carbide heterojunction device using an aluminum substrate to demonstrate that a silicon interface is not essential for fabrication of the device (see column 2, lines 37+).

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Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus, as disclosed by the combination of Seki et al., Seong-Don Hwang et al., Dowben ('834) and Lund et al. by the teaching of Dowben ('611), have a metal substrate instead of a semiconductor substrate because such modification is no more than the substitution of one substrate material by another well-known material in the within the nuclear instrumentation art.


Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rick Palabrica whose telephone number is 703-306-5756. The examiner can normally be reached on 8:00-4:30, Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Carone can be reached on 703-306-4198. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-7687 for regular communications and 703-305-7687 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1113.

RJP
April 15, 2003


RICK PALABRICA
703-306-5756
4/16/03